

ENV

METHYL BROMIDE PROCEDURES
FOR
SPACE FUMIGATIONS

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MINISTRY OF THE ENVIRONMENT
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PHYSICAL PROPERTIES OF METHYL BROMIDE

Common Name	Methyl Bromide
Formula	CH ₃ Br
Commercial Grades	Not less than 99.4% pure
Physical State	Gas at normal temperature and pressure. Liquid under pressure in cylinders or cans at normal temperature.
Flammability limits in air	nonflammable
Critical Temperature	194°C
Boiling Point	4.6°C at 760 mm. Hg.
Freezing Point	- 93°C
Colour	Colourless
Pertinent chemical properties	Powerful solvent of organic materials, especially natural rubber. When pure, noncorrosive to metals. The methyl bromide liquid reacts with aluminum and the compound formed ignites spontaneously in the presence of oxygen.
Odour	Odourless except for relatively high concentrations which have a sweet, chloroform-like odour.
Solubility in Water	1.75 g/100 g. at 20°C, 748 mm.Hg. (very slight)
Specific Gravity of Liquid	1.732 at 0°C and 760 mm.
Threshold Limit Value (Skin)	15 ppm or 60 mg/M ³ (ACGIH-1974).
Specific Gravity of Gas (Air = 1)	3.27 at 0°C and 760 mm.

METHYL BROMIDE AS A FUMIGANT

Methyl bromide is a very efficient space fumigant. Fumigation with this gas, must be done by qualified personnel because of the extreme toxicity of the gas. In order to use methyl bromide in a space fumigation, the applicator must be licenced and obtain a permit from the Ontario Ministry of the Environment, Pesticides Control Section.

Methyl bromide has demonstrated its effectiveness on many species of insects, rodents and other pests. It kills insects in all stages of their life cycles: egg, larva, pupa and adult. It is registered in Canada for the following uses:

A.	<u>USE</u>	<u>RATE OF APPLICATION</u>
	BOX CARS, BULK GRAIN STORAGES, FOOD AND CEREAL MILLS, FUMIGATION VAULTS, SHIPS, WAREHOUSES storage insects in all life stages (bran bugs, cadelles, grain beetles, grain borers, granary weevil, meal moth, meal- worms, mites, rice weevil), rats, mice and other rodents	1.3 - 6.5kg per 100 m ³ Seal all doors and visible cracks. For railroad refrigerator cars or for gas-tight tarpaulins, use 2.5 to 3.25kg of methyl bromide per 100 cubic metre of space. Above 21°C the bulk grain dosage rate for shelled corn is 3.25kg of methyl bromide per 100 cubic metre for wheat (similar small grains) use 4.75kg pounds of methyl bromide per 100 cubic metre; for milo (grain sorghum) use 6.5kg of methyl bromide per 100 cubic metre. If grain temperatures are between 15°C and 21°C increase dosage 25 to 50%. The exposure period at 21°C or above is 18 to 24 hours. For rodent control use 400g of methyl bromide per 100 cubic metre for six hour exposure in a well sealed building.

Methyl bromide has the ability to penetrate almost any commodity very readily and achieves a complete kill within 24 hours. While temperatures and other environmental conditions will affect the dosage required, this exposure may be shortened to a minimum of 8 hours if the dosage of methyl bromide is increased proportionally to the space under fumigation.

TYPES OF BUILDINGS THAT CAN BE FUMIGATED WITH METHYL BROMIDE

Almost any type of building that is in a sound condition, (good repair and reasonably air tight) can be fumigated. Some problems have been encountered with the concrete block buildings because of their porous nature, but these buildings can be fumigated by increasing the dosage and the time of exposure to compensate for the loss by diffusion. There is no "rule of thumb" to compensate for the leakage; the exterminator should exercise his own judgement by observing the condition of the building in order to overcome this problem.

ADVERSE EFFECT ON MISCELLANEOUS MATERIALS

The fumigation of some foodstuffs with methyl bromide may result in the creation of undesirable taints or odours. These may be transitory or permanent. In some instances they may be attributed to reactions with sulphur or sulphur compounds originally present or added during processing. Do not fumigate if the produce concerned will be damaged. With grain, if the moisture is high or if the grain temperature is below 16°C, fumigation should not be carried out.

The following materials, foodstuffs and others, should not be exposed to methyl bromide, or should be exposed only after conducting preliminary tests with small samples (Dow Chemical Company, 1957):

1. iodized salt stabilized with sodium hyposulphite;
2. salt blocks used for cattle licks;
3. certain soap powders and baking sodas;
4. sponge rubber;
5. foam rubber as in rug padding, pillows, cushions and mattresses;
6. rubber stamps and similar forms of reclaimed rubber;
7. furs, horsehair and pillows (especially feather pillows);
8. leather goods, particularly white kid or any other leather goods tanned with a sulphur process;
9. woollens, especially angora;
10. viscose rayons, made by a process that uses carbon disulphide;
11. cinder blocks or mixed concrete and cinder blocks;

12. charcoal, which not only becomes contaminated but absorbs great amounts of methyl bromide and thus reduces effective fumigant concentrations;
13. paper that has been cured by a sulphide process and silver polishing paper;
14. photographic chemicals - not including cameras or films;
15. rug padding;
16. any other materials that may contain reactive sulphur compounds.

Effect On Metal, Plastic And Rubber

Methyl bromide is a powerful solvent of organic materials, plastics and natural rubber. When pure it is non-corrosive to metals. The methyl bromide liquid reacts with aluminum and the compound formed ignites spontaneously in the presence of oxygen.

Synthetic rubber tubing (neoprene) should be used instead of natural rubber when lengths of tubing have to be joined in preparing for a fumigation.

PRECAUTIONS

Methyl bromide may react in the presence of a flame or glowing wire to form hydrobromic acid which may be corrosive or injurious to many materials e.g. stainless steel.

FUMIGATION PROCEDURE

PLANNING AND PREPARATION

Because fully acquainted with the building and commodity to be fumigated.

1. Know the general layout of the structure and all escape routes.
2. Determine the previous treatment history of any commodities present.
3. Locate utility service connections and be familiar with locations of shut-offs and telephones.
4. Apply for and receive a permit for the fumigation from the Director as indicated under The Pesticides Act and Regulation.
5. At least 24 hours before the fumigation notify local fire and police department, in writing, of the chemical to be used, date of use, and safety equipment.

6. Inform every occupant of the building (or the owner or his representative) of the fumigation in writing, at least 24 hours before the fumigation.
8. Arrange all equipment and provide for standby equipment.
9. Thoroughly seal all vents, drains, windows, doors, and other openings. Security and adult guards must be provided. As well, warning signs 35cm x 25cm saying "Danger" in red letters 6.4cm high on a white background and details of the extermination should be placed at each entrance. These signs must be illuminated at night.
10. Plan the ventilation of all treated areas well in advance.
11. Check the entire area for any open flames, motors or other hot surfaces. The temperature in the building must be at least 16°C during fumigation.
12. Because methyl bromide is heavier than air, artificial circulation is required by means of fans to ensure even distribution. One 40cm fan is sufficient for every 1400 cu. metres. Place cylinders and fans in locations suitable to obtain maximum distribution of gas. Provision should be made to switch the fans off from outside the building.

Methyl bromide cylinders should be placed according to dosage requirements at strategic points throughout the structure so that the valves may be fully opened by the operators, wearing respirators, as they retreat toward the final exit.

In large operations, or in structures with high ceilings or roofs, stand pipes (curved copper tubing directed upward) are often attached to the cylinder outlets to distribute the gas which is heavier than air, at a greater height. In this technique, a short "T" is fitted to the top of the pipe to discharge the gas laterally and prevent contact with the ceiling. Liquid methyl bromide should not come directly in contact with painted surfaces.

13. Go through a simulated fumigation first so that everyone knows his duties. Two qualified exterminators must work together at all times.
14. For a large fumigation, it would be helpful to mark arrows in chalk on floors to indicate direction and order of movements of the exterminators as gas is discharged.

Under no conditions should the exterminators be in the building longer than 30 minutes from initial release of the gas. They should wear approved gas masks with canisters or approved self-contained breathing apparatus.

Remove caps and crack valves of gas cylinders.

15. Make a final check to clear all personnel. Call out loudly that a gas is being released to be sure all is clear.
16. Put on proper approved breathing apparatus. These respirators should not be removed until the workmen have reached fresh air, and the fumigant has been completely discharged.
17. Release the gas. During the course of the treatment, regular checks should be made for leakage of the fumigant outside the building. This is necessary for safety and also to prevent a failure of the treatment because of loss of the gas.
18. Aerate the building after the required contact period (usually 24 hours). When commencing aeration, both exterminators should put on proper breathing apparatus again. Open as many doors and windows as possible from the outside. Start ventilators and fans. Leave the immediate vicinity for approximately 30 minutes. Then, with approved breathing apparatus on, enter the building to open doors and windows. Enter the building for short periods of time only, then withdraw into fresh air, remove respirator for about 15 minutes then put it on again and re-enter the structure to open more windows. Allow at least one hour to aerate. At the end of this period, the halide leak detector will then indicate areas requiring additional aeration. Check at the floor level in corners, closets, store rooms, basement where methyl bromide may accumulate, as well as the main open areas.
19. When the exterminators have determined that the building has been properly aired, tests for any residual fumigant must be carried out. Some materials retain gas, such as flours, grain meals and jute bags. This retention may be prolonged when introducing cold air into a building that was warm during the fumigation. In this case, the building must be reheated and tested for any residue.

USE OF THE HALIDE GAS DETECTOR

1. After releasing the gas, check from the outside, the first floor and basement doors, windows and other openings for excessive leakage. Seal any substantial leaks.
2. Check the concentration of gas when aeration of the building begins. This check indicates the approximate amount of gas to which the exterminators will be exposed during aeration. It will also give an indication of the leakage of the building during the fumigation. This information is helpful in determining the dosage to use in future fumigations of the building.
3. During aeration, rest periods should be taken by the exterminators. Although the rest stations should be a considerable distance from the building under fumigation and in an area free from gas, it is always advisable to check with the gas detector to be sure no gas is present.

4. Use the gas detector to determine when the building is completely aerated and safe to be turned back to the owner for re-entry by the workmen.

DETERMINATION OF METHYL BROMIDE GAS

The Halide Leak Detector is the most useful means of determining the absence or presence of harmful concentrations of methyl bromide gas. This detector operates with an acetylene gas flame. In air containing methyl bromide, a green or blue flame will be seen in the torch depending on the concentration of methyl bromide.

The following table gives the approximate methyl bromide concentration associated with colour intensity in the flame.

<u>Methyl Bromide Present in p.p.m.</u>	<u>Reaction Of Flame</u>
0	Very light blue
10	Very faint green tinge at edge of flame
20	Light green edge to flame
30	Light green flame
100	Moderate green
200	Intense green, blue at edge
500	Blue green
1000	Intense blue

If the gas is detectable with your halide leak detector, it is not safe for any person to be in the area without suitable breathing apparatus

Gas detector tubes are also available from safety supply companies.

GAS MASKS AND SELF-CONTAINED BREATHING APPARATUS

An approved gas mask or an approved self-contained breathing apparatus should always be worn whenever there is any possibility of exposure to methyl bromide. Gas masks or self-contained breathing apparatus should be approved by the U.S. Bureau of Mines and/or the National Institute for Occupational Safety and Health (NIOSH) for use in a methyl bromide atmosphere. If you require any help in choosing protective equipment, you should contact the Pesticide Control Personnel, Ontario Ministry of the Environment in your area.

Before entering an atmosphere containing methyl bromide, be sure to check the mask for leaks. To do this put on the mask with the canister attached. Place a hand over the hole in the bottom of the canister and inhale.

If perfectly tight, the face mask will collapse. Canister gas masks are only air purifying devices, therefore, it is essential that they are used in atmospheres which contain sufficient oxygen to support life (more than 16% at sea level) and which contain generally no more than 2% concentration of methyl bromide by volume. If the specific exposure concentration of methyl bromide by volume. If the specific exposure concentrations are suspected of exceeding the above limitation, only a self-contained breathing apparatus should be used.

The operational life of a canister can vary from several minutes to an hour depending on the design and/or the concentration to which it has been exposed. Once the canister becomes saturated with methyl bromide it no longer protects the wearer.

Unless the maximum time that a canister should be used in a methyl bromide fumigation can be pre-determined, a canister once used, should be broken and discarded for there is no sure way of determining the residual protection remaining in that canister.

HAZARDS

Health Hazards

Methyl bromide is a very toxic chemical. Oral intake, vapour inhalation, or prolonged or repeated contact with the skin is harmful. Liquid contact with skin or mucous membranes can cause severe burns. Exposure to high concentrations of vapour may cause delayed skin burns. Vapour inhalation will cause lung irritation, varying from mild bronchitis to respiratory failure. The respiratory effects are usually accompanied or followed by effects on the central nervous system.

The threshold limit value suggested by the American Conference of Governmental Industrial Hygienists is 15 ppm in air by volume.

The threshold limit value refers to airborne concentrations of methyl bromide to which a worker may repeatedly be exposed for 8 hours day after day without adverse effects.

Handling Precautions for Methyl Bromide

As methyl bromide is an extremely toxic chemical it should only be handled by qualified personnel. Rubber gloves, jewelery, cigarettes, wallets etc. should not be worn or on ones person when in an atmosphere containing methyl bromide.

Human Exposure to Methyl Bromide

Poisoning may be either acute or chronic. Acute poisoning may result from contact of the liquid with the skin or from inhalation of its vapours.

On prolonged contact with the skin, a blister commonly forms which is not unlike the blisters resulting from thermal burns or severe chilling. Burns resulting from exposure to methyl bromide should be left alone and the affected person should see his physician.

Repeated inhalation of small amounts of methyl bromide may become cumulative and result in chronic poisoning with any of the symptoms listed here.

The following are possible symptoms of methyl bromide exposure:

Nausea and vomiting	Blurred vision
Dizziness or headache	Difficult breathing
Weakness	Convulsions
Slurred speech	

At the first sign of any of the above symptoms the affected person with his assistants should immediately get out of the fumigation area and into the fresh air. Under some circumstances, symptoms may not show up until 48 hours after exposure.

The patient should be kept warm and the doctor called immediately. If the patient stops breathing administer artificial respiration until a doctor arrives and takes charge. There is no antidote. The booklet containing procedure for "First Aid and Treatment for Methyl Bromide Exposure" should be given to the doctor who takes charge of the patient. This booklet is available at your local dealer or Dow Chemical Company. However, it should be supplied by the dealer with each sale of methyl bromide.

FIRST AID

In case of an accident, call a physician immediately. If there has been liquid contact with skin or clothing, remove all clothing, wash the skin with plenty of soap and water. If in eyes, flush with water for at least 15 minutes. If inhaled, place patient in fresh air, face downward, with head slightly below level of lungs. The patient should be kept warm. If the patient stops breathing administer artificial respiration until a doctor arrives and takes charge.



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